

WHAT IS CLAIMED IS:

1 1. An electric-operated pressure-regulated fluid flow control valve comprising
2 a valve mechanism that is positioned within a valve body by an electric control signal
3 to control fluid flow through the valve body and that has a frequency response
4 characteristic which renders the valve mechanism incapable of faithfully tracking the
5 fundamental frequency of an electric control signal whose fundamental frequency is
6 greater than a predetermined frequency that, when applied in control of the valve
7 mechanism, positions the valve mechanism to a position corresponding to a most
8 recent time average of the electric control signal free of any significant pulsing of the
9 valve mechanism, and a pressure regulator comprising a flow path having an entrance
10 through which fluid flow that has passed through the valve mechanism enters the
11 pressure regulator flow path and an exit from which fluid flow that has entered the
12 pressure regulator flow path exits the pressure regulator flow path, said pressure
13 regulator comprising a pressure regulating mechanism that regulates the pressure at the
14 entrance of the pressure regulator flow path to a pressure that is essentially
15 independent of pressure at the exit of the pressure regulator flow path.

1 2. A fluid flow control valve as set forth in claim 1 wherein said pressure
2 regulator comprises a body enclosing an interior space, and said pressure regulating
3 mechanism comprises a movable wall dividing the interior space into a first chamber
4 space and a second chamber space, said second chamber space forming a portion of
5 the pressure regulator flow path, and said first chamber space being communicated to a
6 reference pressure.

1 3. A fluid flow control valve as set forth in claim 2 wherein said reference
2 pressure is ambient atmospheric pressure.

1 4. A fluid flow control valve as set forth in claim 2 wherein the exit of said
2 pressure regulator flow path is communicated to a variable vacuum.

1 5. A fluid flow control valve as set forth in claim 2 wherein said pressure
2 regulator entrance comprises an external nipple, and further including a conduit fitted
3 to said nipple to convey fluid from the valve body to the nipple.

1 6. A fluid flow control valve as set forth in claim 2 wherein the valve body and
2 the pressure regulator body are assembled together to form an enclosure through
3 which fluid flow passes from the valve mechanism to the pressure regulating
4 mechanism.

1 7. A fluid flow control valve as set forth in claim 1 wherein said pressure
2 regulating mechanism comprises a movable wall separating a variable volume first
3 chamber space from a variable volume second chamber space, said second chamber
4 space forming a portion of the pressure regulator flow path, and said first chamber
5 space being communicated to a reference pressure.

1 8. A fluid flow control valve as set forth in claim 7 wherein said movable wall
2 comprises a rigid disk disposed centrally on said movable wall and a flexible member
3 circumscribing said disk, and further including a seal element disposed centrally on said
4 disk.

1 9. A fluid flow control valve as set forth in claim 8 wherein said pressure
2 regulating mechanism includes a helical coiled spring having one axial end bearing
3 against said disk and circumscribing said seal element.

1 10. A fluid flow control valve as set forth in claim 8 wherein said helical coiled
2 spring and said seal element are disposed in said second chamber space.

1 11. A fluid flow control valve as set forth in claim 7 wherein said pressure
2 regulator further comprises a walled conduit having an open end disposed in the
3 second chamber space in juxtaposition to a central region of the movable wall and
4 leading to the pressure regulator flow path exit, the movable wall further comprising a
5 flexible convoluted member circumscribing the central region of the movable wall to
6 allow unrestricted movement of the central region relative to the open end of the
7 walled conduit.

1 12. A fluid flow control valve as set forth in claim 11 wherein said pressure
2 regulating mechanism includes a spring bearing against the central region of the
3 movable wall and urging the central region of the movable wall away from the open
4 end of the walled conduit.

1 13. A fluid flow control valve as set forth in claim 12 wherein said spring
2 comprises a helical coiled spring having an axial end bearing against the central region
3 of the movable wall, said spring being disposed in said second chamber space.

1 14. A fluid flow control valve as set forth in claim 13 wherein the central region
2 of the movable wall comprises a rigid disk against which the axial end of the spring
3 bears.

1 15. A fluid flow control valve as set forth in claim 14 wherein the central region
2 of the movable wall comprises a seal element disposed on a central region of the rigid
3 disk in juxtaposition to the open end of the walled conduit and circumscribed by the
4 axial end of the spring.

1 16. A fluid flow control valve as set forth in claim 1 wherein the valve
2 mechanism comprises a linear solenoid actuator to which the electric control signal is
3 applied.

1 17. A fluid flow control valve as set forth in claim 16 wherein the linear
2 solenoid actuator comprises a bobbin, a coil on the bobbin to which the electric control
3 signal is applied, stator structure associated with the coil, and an overmold joining the
4 bobbin and the stator structure in assembly and covering the coil.

1 18. A fluid flow control valve as set forth in claim 16 further including an
2 electric control circuit that applies the electric signal to the linear solenoid actuator at a
3 fundamental frequency substantially greater than the frequency response characteristic
4 of the valve mechanism.

1 19. An electric-operated pressure-regulated fuel vapor purge valve for purging
2 fuel vapor from a fuel tank to an intake manifold of an internal combustion engine
3 comprising a valve mechanism that is positioned within a valve body by an electric
4 control signal to control flow through the valve body and that has a frequency
5 response characteristic which renders the valve mechanism incapable of faithfully
6 tracking the fundamental frequency of an electric control signal whose fundamental
7 frequency is greater than a predetermined frequency that, when applied in control of
8 the valve mechanism, positions the valve mechanism to a position corresponding to a
9 most recent time average of the electric control signal free of any significant pulsing of
10 the valve mechanism, and a pressure regulator comprising a flow path having an
11 entrance through which flow that has passed through the valve mechanism enters the

12 pressure regulator flow path and an exit for communicating the pressure regulator flow
13 path to an engine intake manifold, said pressure regulator comprising a pressure
14 regulating mechanism that regulates the pressure at the entrance of the pressure
15 regulator flow path to a pressure that is essentially independent of intake manifold
16 vacuum.

1 20. A fuel vapor purge valve as set forth in claim 19 wherein said pressure
2 regulator comprises a body enclosing an interior space, and said pressure regulating
3 mechanism comprises a movable wall dividing the interior space into a first chamber
4 space and a second chamber space, said second chamber space forming a portion of
5 the pressure regulator flow path, and said first chamber space being communicated to a
6 reference pressure.

1 21. A fuel vapor purge valve as set forth in claim 20 wherein said reference
2 pressure is ambient atmospheric pressure.

1 22. A fuel vapor purge valve as set forth in claim 20 wherein said pressure
2 regulator entrance comprises an external nipple, and further including a conduit fitted
3 to said nipple to convey flow from the valve body to the nipple.

1 23. A fuel vapor purge valve as set forth in claim 20 wherein the valve body
2 and the pressure regulator body are assembled together to form an enclosure through
3 which flow passes from the valve mechanism to the pressure regulating mechanism.

1 24. A fuel vapor purge valve as set forth in claim 19 wherein said pressure
2 regulating mechanism comprises a movable wall separating a variable volume first
3 chamber space from a variable volume second chamber space, said second chamber
4 space forming a portion of the pressure regulator flow path, and said first chamber
5 space being communicated to a reference pressure.

1 25. A fuel vapor purge valve as set forth in claim 24 wherein said movable wall
2 comprises a rigid disk disposed centrally on said movable wall and a flexible member
3 circumscribing said disk, and further including a seal element disposed centrally on said
4 disk.

1 26. A fuel vapor purge valve as set forth in claim 25 wherein said pressure
2 regulating mechanism includes a helical coiled spring having one axial end bearing
3 against said disk and circumscribing said seal element.

1 27. A fuel vapor purge valve as set forth in claim 26 wherein said helical coiled
2 spring and said seal element are disposed in said second chamber space.

1 28. A fuel vapor purge valve as set forth in claim 24 wherein said pressure
2 regulator further comprises a walled conduit having an open end disposed in the
3 second chamber space in juxtaposition to a central region of the movable wall and
4 leading to the pressure regulator flow path exit, the movable wall further comprising a
5 flexible convoluted member circumscribing the central region of the movable wall to
6 allow unrestricted movement of the central region relative to the open end of the
7 walled conduit.

1 29. A fuel vapor purge valve as set forth in claim 28 wherein said pressure
2 regulating mechanism includes a spring bearing against the central region of the
3 movable wall and urging the central region of the movable wall away from the open
4 end of the walled conduit.

1 30. A fuel vapor purge valve as set forth in claim 29 wherein said spring
2 comprises a helical coiled spring having an axial end bearing against the central region
3 of the movable wall, said spring being disposed in said second chamber space.

1 31. A fuel vapor purge valve as set forth in claim 30 wherein the central region
2 of the movable wall comprises a rigid disk against which the axial end of the spring
3 bears.

1 32. A fuel vapor purge valve as set forth in claim 31 wherein the central region
2 of the movable wall comprises a seal element disposed on a central region of the rigid
3 disk in juxtaposition to the open end of the walled conduit and circumscribed by the
4 axial end of the spring.

1 33. A fuel vapor purge valve as set forth in claim 19 wherein the valve
2 mechanism comprises a linear solenoid actuator to which the electric control signal is
3 applied.

1 34. A fuel vapor purge valve as set forth in claim 33 wherein the linear solenoid
2 actuator comprises a bobbin, a coil on the bobbin to which the electric control signal is
3 applied, stator structure associated with the coil, and an overmold joining the bobbin
4 and the stator structure in assembly and covering the coil.

1 35. A fuel vapor purge valve as set forth in claim 34 further including an
2 electric control circuit that applies the electric signal to the linear solenoid actuator at a
3 fundamental frequency substantially greater than the frequency response characteristic
4 of the valve mechanism.